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Microshear Bond Strength of Zirconia-Reinforced Lithium Silicate Ceramic Bonded to Dentin

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Abstract

To examine microshear bond strength (μSBS) of zirconia-reinforced lithium silicate ceramics (ZLS) bonded to dentin, Celtra Duo (CD) blocks were sectioned into 24 microbars (1×1×3 mm^3). Half of CD were additionally fired and defined as fired-Celtra Duo (fired-CD). The other was defined as unfired-Celtra Duo (unfired-CD). Each microbar was cemented to each flat occlusal dentin surface of human premolar using Single Bond Universal (SU) combined with RelyX Ultimate (n=12 per group). 24-hour μSBS was then determined, and data were analyzed using independent T-test (α = .05). Failure modes were analyzed under a stereomicroscope at 40×. Independent T-test revealed that type of ZLS had no influence on μSBS (*P*=.159). Failure mode was predominantly cohesive failure in luting cement for fired-CD (66.7%) and adhesive failure between cement and dentin for unfired-CD (58.3%). The finding can be concluded that unfired-CD and fired-CD comparably achieved μSBS when they were bonded to dentin using universal adhesive resin luting cement.

Keywords**:** *Microshear bond strength, Zirconia-reinforced lithium silicate ceramics*

1. Introduction

The ceramics classification proposed by Valandro et al (2005) was based on the existence of ceramic surface degradation by hydrofluoric acid (HF). Ceramics with high glass content in their composition, such as feldspar-, leucite-, and lithium disilicate-based ceramics, can be etched by hydrofluoric acid, resulting in a micromechanical retentive surface and they are called acid sensitive or glass ceramics (Valandroet al., 2005). Nowadays, the glass ceramics are mainly lithium disilicate-based pressable ingots or CAD/CAM blocks (Guess et al., 2013). These ceramics exhibit translucency and aesthetic appearance superior to those high strength polycrystalline ceramics (Raptis, Michalakis, & Hirayama, 2006).

Ceramics based on glass infiltrated alumina or zirconia, densely sintered alumina, and yttria-tetragonal zirconia polycrystal (Y-TZP) cannot be degraded by hydrofluoric acid, do not present micromechanical retention, and are referred to as acid resistant or polycrystalline ceramics (Valandro et al., 2005). Y-TZP has excellent mechanical properties, with a broad range of indications from frameworks for bridges to frameworks for single crowns (Sailer et al., 2015). Although in the recent time, new high translucency stabilized zirconia has been introduced for monolithic full contour restorations, but they still remain opaque (Zhang, 2014). This aspect limits their use as monolithic restorations in the posterior region only (Traini et al., 2014). On the other hand, veneered zirconia restorations showed a considerable clinical rate of chipping and delamination of the veneering glass-ceramic (Larsson & Wennerberg, 2014).

Recently, a new material, zirconia-reinforced lithium silicate ceramic (ZLS), was launched under the argument that zirconia could act as a crystal phase that can reinforce the material; which can avoid crack propagation. Moreover, this material can perform esthetic excellence because of the glass-ceramics composition in a form of monolithic restoration, so ZLS could be etched by hydrofluoric acid and cemented with adhesive systems (Preis et al., 2015; Sato et al., 2016).

Nowadays, there are two brands of ZLS in the market. The ZLS Vita Suprinity (Vita Zahnfabrik) is a pre-crystallized ceramic material. Therefore, it needs a crystallization firing after milling to achieve the final density. However, the ZLS Celtra Duo (CD, Dentsply Sirona) is a finally crystallized ceramic. It can be delivered directly after finishing and polishing. The milled restoration (unfired-Celtra Duo, unfired-CD) has a flexural strength of 210 MPa. Alternatively, an additional stain and glaze firing (fired-Celtra Duo, fired-CD) will increase the material's flexural strength to 370 MPa (Qeblawi et al., 2010).